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Teaching factory-based video learning to enhance vocational hospitality skills

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Abstract. The persistent mismatch between school-based instruction and industry-required competencies remains a critical challenge in vocational hospitality education, particularly in integrating cognitive mastery with professional soft skills. Existing studies predominantly emphasize technical skill acquisition, leaving a research gap in the development of integrated multimedia-based Teaching Factory (Tefa) models that simultaneously enhance knowledge and behavioral competencies. This study aims to develop and rigorously evaluate a Tefa-based video learning model to address this gap. Employing a Research and Development (R&D) design based on the Alessi and Trollip model, the study involved vocational students in hospitality programs (Class XI PH1 and PH3). Data were collected using expert validation instruments, student usability questionnaires, soft skills observation sheets, and pretest–posttest assessments. Data analysis combined descriptive statistics, gain score analysis, and effect size estimation to ensure robust evaluation. The findings demonstrate high validity (media: 96.25%; material: 98%) and strong practicality (student response >90%; teacher response: 92.6%). Learning outcomes improved significantly (PH1: 5.55→6.55; PH3: 6.32→8.14), with effect sizes of 0.44 (moderate) and 0.80 (large). Notably, the model also enhanced students' communication and service-oriented soft skills through behavioral modeling. This study contributes a scalable, industry-aligned instructional model that effectively bridges the theory-practice divide in vocational education.

Introduction

Vocational education plays a strategic role in preparing a competent, adaptable workforce capable of meeting the demands of global industry. In the Indonesian context, Vocational High Schools (SMKs) are expected not only to equip students with technical expertise but also to develop strong interpersonal competencies, particularly in service-oriented fields. However, existing evidence suggests that graduates, especially those in hospitality programs, continue to face significant competency gaps, particularly in service communication skills. This competency is critical, as the hospitality industry relies heavily on effective interactions between staff and customers from diverse cultural backgrounds (Akbari, 2018; Liu et al., 2022).

This issue is not confined to local contexts but reflects a broader global challenge in vocational education. Studies by Ferreras-Garcia et al. (2020) and Shereni (2020) highlight that deficiencies in

soft skills, particularly communication and service excellence, significantly contribute to the low competitiveness of vocational graduates in the ASEAN region. More recent research further identifies a persistent mismatch between vocational curricula and industry requirements as a key barrier to graduate employability (Putra et al., 2022; Raras et al., 2024). Empirical data from SMKN 6 Kota Jambi reinforce this concern, indicating that 73% of students lack confidence in service communication practices, while 61% of learning activities remain limited to classroom-based simulations. These findings suggest a clear gap between students' learning experiences and real-world industry expectations.

Conceptually, this gap reflects the suboptimal implementation of industry-based learning approaches within vocational education. One widely recommended approach is the Teaching Factory (Tefa), which integrates learning processes with real-world work environments. Previous studies demonstrate that learning factory models enhance students' work-readiness by providing authentic learning experiences that integrate technical and non-technical competencies (Abele et al., 2019; Sudiyono et al., 2019). In recent developments, this approach has been further strengthened through the integration of digital technologies, enabling more flexible, contextual, and adaptive learning environments aligned with Industry 4.0 demands (Bauernhansl & al., 2021; Mourtzis & al., 2022).

Despite its potential, the implementation of the Teaching Factory in Indonesia remains constrained by several structural and pedagogical challenges. Pratama et al. (2025); Erawati & Adnyana (2024) found that many institutions still perceive Tefa primarily as a production-oriented activity rather than a fully integrated instructional strategy. Additionally, limitations in infrastructure, instructional time, and teachers' competencies in developing industry-based learning media hinder the effective adoption of this approach. Recent studies also indicate that insufficient integration of digital technologies in vocational learning environments leads to suboptimal learning experiences (Hassan, 2023; Tuo et al., 2025).

In the context of digital transformation in education, video-based learning emerges as a promising solution to address these limitations. Instructional videos enable the visualization of authentic work practices, enhance learner motivation, and support repeated and flexible learning. Research by Eamcharoen (2024) indicates that video-based learning improves student engagement and understanding in vocational contexts. Similarly, Mayer (2021) and Zhang et al. (2021) argue that multimedia learning significantly enhances conceptual understanding and practical skill acquisition compared to traditional methods. Furthermore, empirical studies demonstrate that integrating video into vocational learning environments improves both engagement and practical learning effectiveness (Chen & al., 2021; Wu, 2024; Pedry et al., 2024).

However, a critical review of the literature reveals several unresolved research gaps. First, most studies on Teaching Factory primarily focus on managerial and production aspects, with limited attention to integrating digital learning media, particularly video-based instruction. Second, existing instructional videos in hospitality education tend to be generic and often fail to reflect local contexts and specific industry needs (Isnantyo et al., 2024). Third, there is limited research on actively involving students in producing learning media, despite evidence suggesting that participatory approaches can enhance 21st-century skills such as creativity, collaboration, and digital literacy (Hassan, 2023). Finally, the integration of reflective learning elements in video-based vocational education remains underexplored, even though such approaches are essential for fostering deeper professional understanding (Ge & Kim, 2023).

Addressing these gaps, this study introduces a novel instructional model that integrates Teaching Factory principles with multimedia, video-based learning to simultaneously enhance cognitive

outcomes and students' soft skills through behavioral modeling. Unlike previous approaches that predominantly emphasize technical skill acquisition, this model incorporates contextualized industry scenarios, participatory media production, and reflective learning components. This integrated approach not only facilitates knowledge acquisition but also supports the development of professional communication behaviors essential in hospitality services. By embedding behavioral modeling within a multimedia Teaching Factory framework, this study offers a scalable solution to bridge the theory–practice gap in vocational education.

The urgency of this research is further underscored by the hospitality industry's increasing demands, which prioritize service quality and communication competence as key performance indicators. In the era of globalization and digitalization, the ability to deliver effective service communication is a critical determinant of workforce competitiveness. Without innovative instructional interventions, the gap between educational outcomes and industry expectations is likely to widen, ultimately affecting the employability of vocational graduates.

From a broader perspective, this study also contributes to advancing educational technology and policy in vocational education. The integration of digital media within the Teaching Factory framework not only enhances instructional quality but also provides opportunities for developing adaptive and sustainable learning models. Moreover, the participatory approach, involving both teachers and students in media production, strengthens the institutional capacity to respond to the challenges of Industry 4.0.

Based on the above considerations, the primary research question of this study is: how can a contextual, participatory, and reflective Teaching Factory-based video learning model effectively improve students' service communication competencies in vocational hospitality education? Accordingly, this study aims to develop, validate, and evaluate the effectiveness of a Teaching Factory-based video learning model in enhancing students' service communication competencies in a sustainable and contextually relevant manner.

Method

Design

This study employed a Research and Development (R&D) approach using the Alessi & Trollip (2001) model, which emphasizes iterative cycles of design, evaluation, and revision in multimedia product development. This model was selected for its suitability in developing Teaching Factory (Tefa)-based video learning media that require not only content validity but also functional effectiveness within authentic vocational learning contexts. The approach was further strengthened by incorporating a design-based research framework, which enables product testing in real-world settings to achieve ecological validity (Reeves, 2006).

The research procedure consisted of three main phases: planning, design, and development. In the planning phase, a needs analysis was conducted through classroom observations, curriculum analysis, and industry requirements assessment to identify gaps between theoretical instruction and practical application. The design phase involved formulating learning objectives, developing video scenarios and storyboards, and integrating principles of the Cognitive Theory of Multimedia Learning (Mayer, 2009).

The development phase included media production, expert validation (alpha testing) by media and subject-matter experts, product revision, and user testing (beta testing) involving students and teachers. Furthermore, the effectiveness of the developed media was evaluated using a quasi-experimental one-group pretest–posttest design, extended across two different groups to examine

the consistency and generalizability of the media's impact. The procedural framework of the Alessi & Trollip (2001) model is illustrated in Image 1.

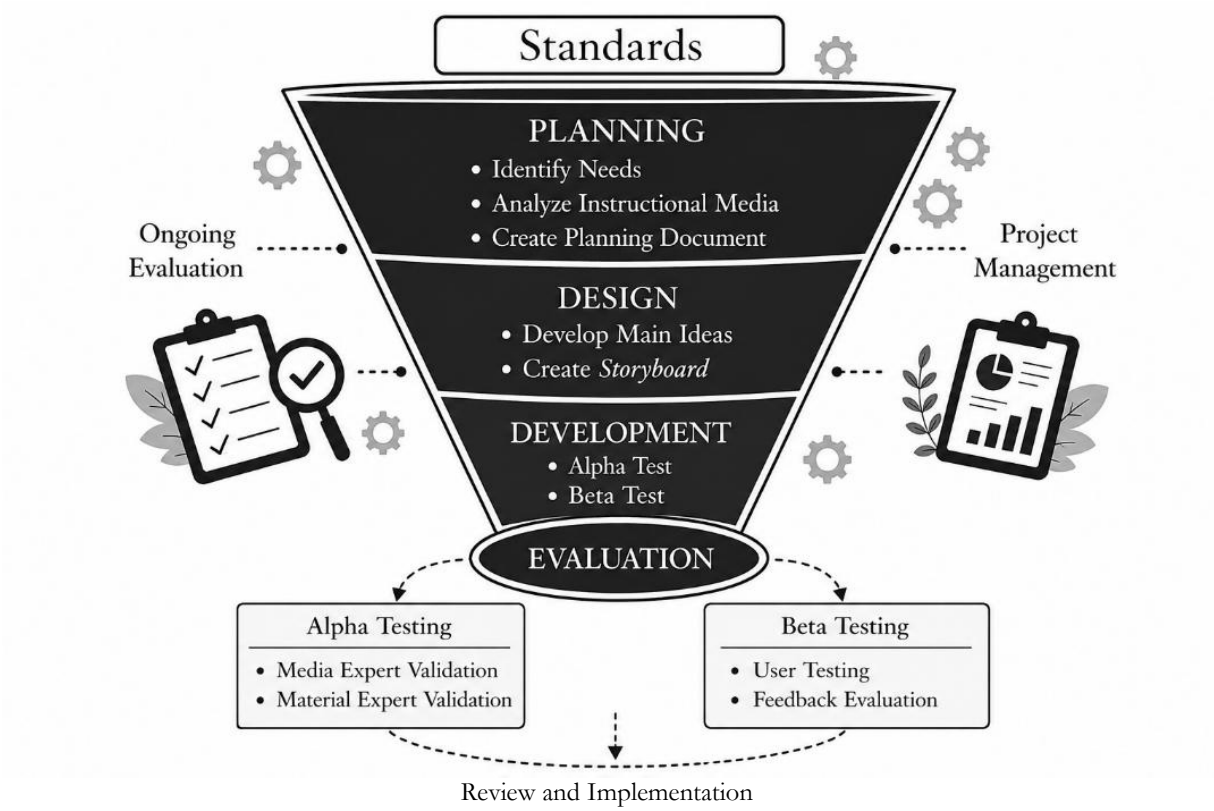

Image 1. Adapted Model Alessi & Trollip (2001)

Participants and Sampling Technique

The participants in this study were selected using a purposive sampling technique, which allows researchers to intentionally select individuals who possess characteristics relevant to the objectives of the study (Creswell & Creswell, 2017). This sampling approach was considered appropriate because the Research and Development (R&D) process requires participants with specific expertise and experiences at different stages of product development and evaluation.

The study involved three groups of participants. First, two expert validators comprising one media expert and one subject-matter expert were selected to assess the validity of the developed multimedia product in terms of content accuracy, instructional appropriateness, and technical quality. Second, one vocational teacher participated as a practitioner evaluator to assess the product's practicality and applicability within classroom settings. Third, Grade XI Hospitality students were involved as end-users to evaluate the product's usability, attractiveness, and effectiveness. Student participants were distributed across three stages of testing: a limited trial (XI PH1, n = 12), an expanded trial (XI PH3, n = 30), and an effectiveness test involving two intact classes (XI PH1 and XI PH2). The selection of participants was therefore guided by the specific requirements of validating, implementing, and evaluating the developed instructional product.

Research Setting and Timeline

This study was conducted at SMK Negeri 6 Kota Jambi, Indonesia, during the first semester of the 2025/2026 academic year, spanning from August to November 2025. The research was implemented in an authentic vocational learning environment to ensure the relevance and applicability of the developed multimedia product within the hospitality education context. The

participants consisted of two expert validators (one media expert and one subject-matter expert), one vocational teacher who served as a practitioner evaluator, and Grade XI Hospitality students involved in different stages of the development process. Specifically, the student participants comprised 12 students in the limited trial (XI PH1), 30 students in the expanded trial (XI PH3), and two intact classes (XI PH1 and XI PH2) that participated in the effectiveness testing phase. Participants were selected using purposive sampling based on predetermined criteria aligned with the objectives and requirements of the Research and Development (R&D) process.

Research Procedures

The research procedure employed in this study followed a systematic and iterative Research and Development (R&D) framework integrating the Teaching Factory (TEFA) approach with multimedia-based learning. As illustrated in Image 2, the development process consisted of six interrelated stages designed to ensure the validity, practicality, and effectiveness of the instructional product.

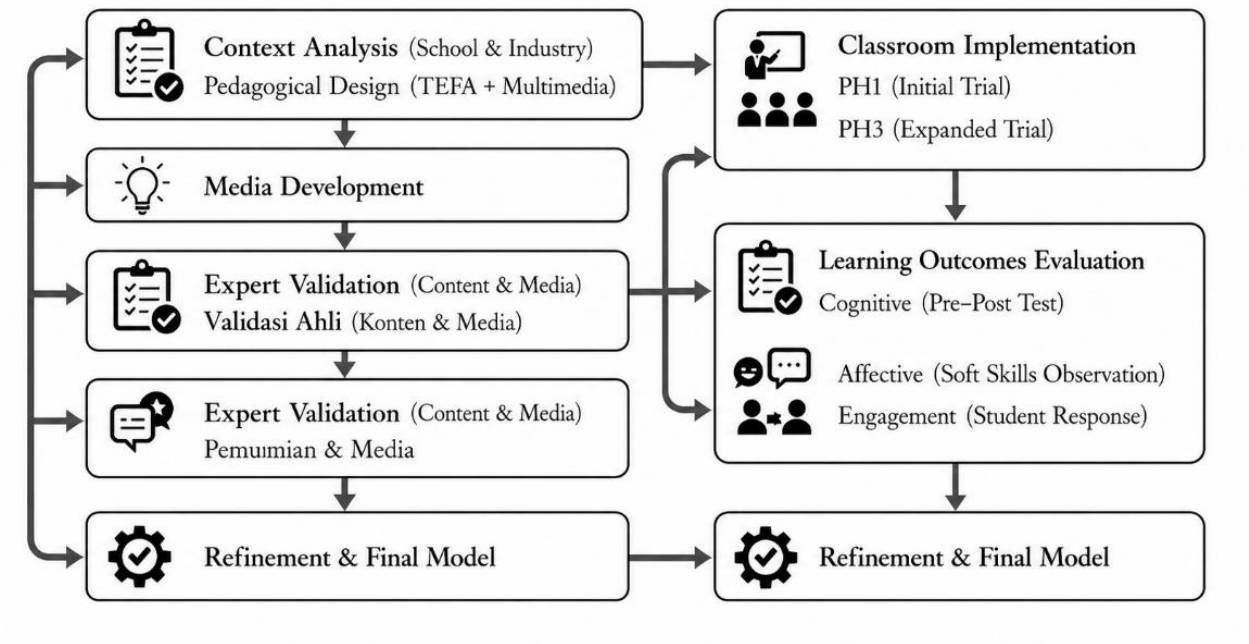

Image 2. Teaching Factory Multimedia Development Process

The study commenced with a Context Analysis to identify educational needs by examining curriculum requirements, student characteristics, and competencies expected by the hospitality industry. Based on this analysis, the Pedagogical Design phase established the instructional framework by integrating Teaching Factory principles with multimedia learning strategies. The multimedia product was then developed according to the instructional design and evaluated through expert validation involving content and media experts to assess its relevance, accuracy, usability, and instructional quality. Following revisions based on expert feedback, the product was implemented in authentic vocational learning environments through two sequential stages: an initial trial (PH1) and an expanded trial (PH3) to examine its feasibility and practicality. The effectiveness of the developed multimedia was evaluated using multiple indicators, including cognitive achievement measured through pre-test and post-test scores, affective development observed through students' soft skills, and learning engagement assessed using response questionnaires. The final product was refined based on evaluation results. All procedures adhered to established educational research ethics, including institutional approval, informed consent, and participant confidentiality.

Data Collection Techniques, Research Instruments, Instrument Validity, and Reliability Tests

The data collection process utilized four complementary research instruments. First, expert validation sheets were employed to evaluate the content accuracy, instructional suitability, visual design, and technical quality of the developed multimedia product. Second, usability and engagement questionnaires were administered to students and teachers to assess perceived ease of use, satisfaction, and instructional effectiveness. Third, structured observation sheets were used to measure students' affective competencies, particularly communication skills, collaboration, discipline, and service-oriented attitudes during classroom activities. Fourth, cognitive learning outcomes were assessed using pretest and posttest instruments developed in alignment with the specified learning objectives. All instruments employed a five-point Likert scale, underwent expert judgment for content validity, and demonstrated satisfactory reliability prior to implementation.

Data Analysis Techniques and Criteria

Data analysis adopted an integrated mixed-methods approach aligned with the objectives of product development. Qualitative data from observations and expert feedback were analysed using thematic analysis to identify patterns of improvement in both the product and students' behavioural changes. Quantitative data were analyzed using descriptive statistics (means and percentages) to evaluate the validity and practicality of the media. The effectiveness of the intervention was examined through comparisons of pretest and posttest mean scores, gain score analysis, and effect size estimation, enabling the identification of educational significance as reflected in improved learning outcomes.

The trustworthiness of qualitative data was ensured through triangulation of sources (experts, teachers, and students) and methods (questionnaires, observations, and tests). Quantitative data quality was established through content validity and internal consistency reliability using Cronbach's Alpha. Furthermore, the inclusion of two distinct groups in the effectiveness testing strengthened external validity and ensured the consistency and generalizability of the findings.

Product Specifications

The developed product is a Teaching Factory-based video learning package designed to enhance vocational hospitality competencies among Grade XI students. The product integrates industry-oriented scenarios, multimedia elements, and competency-based instructional content aligned with the Merdeka Curriculum. It consists of instructional videos, learning guides, formative assessments, and classroom activity sheets. The multimedia package emphasizes authentic learning experiences, service excellence, communication skills, and practical workplace procedures to support cognitive, affective, and psychomotor learning outcomes in vocational hospitality education.

Results and Discussion

Media Expert Validation (Alpha Testing)

Table 1. Media Expert Validation Results

Indicator	Score (%)	Category
Visual Design	95	Highly Appropriate
Audio-Visual Quality	100	Highly Appropriate
Interactivity	95	Highly Appropriate
Content Suitability for Students	100	Highly Appropriate
Multimedia Principles	100	Highly Appropriate
Mean Score	96.25	Highly Appropriate

The validation results indicate that the developed media achieved an overall score of 96.25%, reflecting a very high level of quality. The audio-visual aspect and multimedia principles both reached the maximum score (100%), demonstrating that the video fully adheres to modern multimedia design standards grounded in the *Cognitive Theory of Multimedia Learning*. This finding suggests that the integration of visual and auditory elements has been effectively optimized, thereby supporting efficient information processing. Although the interactivity aspect did not reach the maximum score (95%), it still falls within the *highly appropriate* category. This slightly lower score can be attributed to the absence of explicit interactive features, such as embedded quizzes. However, the intuitive navigation and user-friendly design still provide learners with sufficient control over their learning process.

Overall, these validation results confirm that the developed media is highly feasible for implementation without major revision, indicating its strong instructional quality and usability in vocational learning contexts.

Material Expert Validation (Alpha Testing)

Table 2. Material Expert Validation Results

Indicator	Score (%)	Category
Curriculum Alignment	100	Highly Appropriate
Content Accuracy	100	Highly Appropriate
Media Coherence	90	Highly Appropriate
Learning Meaningfulness	100	Highly Appropriate
Mean Score	98.00	Highly Appropriate

The material expert validation yielded an overall score of 98%, indicating that the video content is highly relevant to the curriculum, aligned with industry requirements, and consistent with the Teaching Factory approach. This finding confirms that the instructional content has been carefully designed to reflect authentic vocational practices. The media coherence aspect received a slightly lower score (90%), suggesting that there is still room for improvement, particularly in aligning practical tools and procedures with real-world industry conditions. Nevertheless, this score remains within the *highly appropriate* range, indicating that the overall integration of content and media remains effective.

These findings further reinforce that the developed material adheres to the principles of instructional alignment, in which learning objectives, content, and assessment are systematically interconnected. Moreover, the high rating for learning meaningfulness indicates that the media effectively bridges theoretical knowledge with practical application, enabling students to engage in contextualized and relevant learning experiences.

Media Trial Results in Class XI PH1 (Beta Testing)

Table 3. Media Usability Results (PH1)

Indicator	Score (%)
Ease of Use	74
Video Duration	77
Content Suitability	89
Clarity of Explanation	89
Skill Support	93

The results of the trial conducted in Class XI Hospitality 1 indicate that the developed learning media demonstrate a good to very good level of usability. The skill support indicator achieved the highest score (93%), suggesting that the media effectively facilitates students in understanding practical tasks in an applied manner. Additionally, both content suitability and clarity of explanation obtained high scores (89%), indicating that the instructional content is comprehensible and well-aligned with students' learning needs. These findings highlight the media's effectiveness in delivering relevant, structured learning experiences. However, the ease of use (74%) and video duration (77%) received relatively lower scores. These results suggest the need for further refinement, particularly in improving interface design and optimizing video length to better match user characteristics and attention span.

Overall, the media supports the learning process well, though minor improvements are recommended to enhance the user experience and efficiency.

Media Attractiveness in Class XI PH1 (Beta Testing)

Table 4. Media Attractiveness Results (PH1)

Indicator	Positive Response (%)
Interesting to Watch	88.9
Not Boring	81.5
Increases Learning Interest	85.2
Enhances Practice Motivation	92.6
Willingness to Rewatch	81.5

The analysis results indicate that the developed learning media are highly attractive to students. The highest score was observed in the enhancement of practice motivation (92.6%), suggesting that the media effectively promotes active engagement in skill-based learning activities. Furthermore, the indicators of interest in watching (88.9%) and increased learning interest (85.2%) reflect that the media successfully creates an engaging and relevant learning experience. These findings highlight the media's capacity to capture students' attention and sustain their motivation during the learning process. However, the indicators of perceived boredom (81.5%) and willingness to rewatch (81.5%) indicate that there is still room to improve long-term engagement and content retention. These aspects suggest the need for further refinement in terms of content variation, pacing, and interactive elements.

Overall, the media has proven effective in enhancing students' motivation and engagement, supporting its suitability for implementation in vocational learning environments.

Trial Consistency in Class XI PH3 (Beta Testing)

Table 5. Media Usability Results (PH3)

Indicator	Score (%)
Ease of Use	92
Video Duration	92
Content Suitability	100
Clarity of Explanation	92
Skill Support	96

The results of the trial conducted in Class XI Hospitality 3 demonstrate that the developed learning media exhibit consistently high usability across all evaluated indicators. The scores for ease of use and video duration both reached 92%, indicating that the media is easily accessible and well-aligned

with the allocated instructional time. The content suitability achieved a perfect score of 100%, confirming that the video content is fully aligned with curriculum requirements and industry practices. In addition, the clarity of explanation (92%) suggests that the instructional delivery is comprehensible and effectively supports students' understanding. The skill support indicator, which scored 96%, further highlights the media's effectiveness in enhancing students' practical competencies. These findings indicate that the media not only meet technical feasibility standards but also demonstrate strong instructional effectiveness in supporting vocational learning.

Overall, the results confirm that the developed media is highly reliable and consistent in facilitating learning, reinforcing its applicability across different classroom contexts.

Media Attractiveness Results in Class XI PH3 (Beta Testing)

Table 6. Media Attractiveness Results (PH3)

Indicator	Positive Response (%)
Interesting to Watch	92.3
Not Boring	88.5
Increases Learning Interest	92.3
Enhances Practice Motivation	96.2
Willingness to Rewatch	88.5

The analysis indicates that the developed learning media are highly attractive for Class XI Hospitality 3. The highest score was obtained for practice motivation (96.2%), demonstrating the media's effectiveness in encouraging active participation in skill-based learning. High scores for interest in watching and increased learning interest (both 92.3%) further show that the media creates an engaging and relevant learning experience, sustaining students' attention and intrinsic motivation. Although perceived boredom and willingness to rewatch (both 88.5%) also fall within the high category, they suggest opportunities to improve long-term engagement and content variety. Overall, the media is highly engaging and significantly enhances students' motivation and participation. Beyond improving cognitive (hard skills) outcomes, the findings also demonstrate meaningful development of soft skills, particularly communication, service attitude, and professional behaviour in hospitality contexts, as illustrated in Image 3.

Image 3. Student Attitudes in Building Communication

Observational findings during the implementation of Teaching Factory (Tefa)-based video learning indicate a positive development in students' soft skills, particularly in building effective communication with hotel guests. Students demonstrated increased confidence in initiating

interactions, such as greeting guests politely, maintaining appropriate body language, and sustaining professional eye contact. These behaviors reflect the emergence of essential interpersonal competencies required in hospitality services. Furthermore, students began to exhibit improved control over voice modulation and facial expressions, enabling them to communicate more clearly and persuasively. This suggests that the learning media not only support cognitive understanding but also facilitate the development of affective and behavioral competencies. The Tefa-based video provided authentic service scenarios, allowing students to observe, imitate, and internalize professional communication standards. Through repeated exposure to modeled interactions, students were able to practice service etiquette more naturally, including demonstrating respect toward guests and responding promptly and appropriately.

Overall, these findings confirm that video-based Tefa learning significantly contributes to the development of professional attitudes and communication skills, which are critical components of hospitality competence. The results highlight the effectiveness of behavioral modeling in bridging the gap between theoretical instruction and real-world service practices.

Image 4. Student Attitude at the Front Office and Welcome Drink

Observational findings during the implementation of Teaching Factory (Tefa)-based video learning, as illustrated in Image 4, reveal a significant improvement in students' soft skills, particularly in front office service during the hotel reservation process. Students appeared more confident in their interactions, as reflected in their upright posture, consistent eye contact, and friendly yet professional facial expressions. Moreover, students demonstrated the ability to apply service communication etiquette, including greeting guests politely, listening attentively, and providing clear and structured responses. These behaviours indicate the development of essential interpersonal competencies required in professional hospitality settings. The Tefa-based video provided realistic reservation scenarios, enabling students to understand the complete flow of service communication. Students also showed improvement in managing conversations systematically, including the use of formal language and a confident tone. This suggests that the learning process supports not only technical skill acquisition but also the internalization of professional service attitudes oriented toward guest satisfaction.

Teacher Responses

Table 7. Teacher Responses

Aspect	Score (%)
Usability	93.4
Attractiveness	91.6
Mean Score	92.6

Teacher responses indicate very high usability (93.4%) and attractiveness (91.6%), with an overall mean score of 92.6%. These findings are consistent with student trial results in Classes XI PH1 and PH3, where usability and attractiveness scores also exceeded 90%. This consistency demonstrates strong agreement between teachers' and students' perceptions regarding ease of use, content clarity, and instructional appeal, strengthening the validity of the findings and confirming the media's practicality for classroom implementation. Overall, the Teaching Factory (Tefa)-based video learning media demonstrates excellent quality across multiple evaluation dimensions. Media expert validation (96.25%) and material expert validation (98%) confirm its technical and content feasibility. In addition, student trial results above 90% and teacher responses averaging 92.6% indicate that the media is user-friendly, aligned with curriculum and industry needs, and highly effective in supporting learning. High student acceptance further reflects its attractiveness in enhancing motivation and engagement.

Effectiveness Testing

In addition to evaluating the feasibility and usability of the Teaching Factory (Tefa)-based video media, this study also conducted an effectiveness test to assess students' knowledge acquisition after using the media. The effectiveness test employed a pretest–posttest design with gain-score analysis to determine the extent to which the media enhanced students' learning outcomes. The evaluation involved two classes, including one group that had not previously participated in the trial phase. This design was intended to ensure the consistency and generalizability of the media's effectiveness across different learning contexts. The results of the pretest and posttest comparisons are presented in Table 8.

Table 8. Comparison of Pretest and Posttest Results in Evaluating the Effectiveness of Tefa Video-Based Learning Media

Class	Mean (Pretest)	Mean (Posttest)	Median (Pretest)	Median (Posttest)	SD (Pretest)	SD (Posttest)
XI PH1	5.55	6.55	6.0	7.0	2.31	2.23
XI PH2	6.32	8.14	6.0	9.0	2.27	2.30

The analysis presented in Table 8 shows substantial improvements in pretest-to-posttest scores in both classes. In Class XI PH1, the mean score increased from 5.55 to 6.55, while Class XI PH2 improved more markedly, from 6.32 to 8.14. Median scores also increased in both classes, with relatively stable standard deviations, indicating that learning gains occurred consistently across students rather than being limited to a few individuals. From a gain-score perspective, both classes demonstrated measurable learning progress, with greater improvement in Class XI PH2. This finding indicates that the Teaching Factory-based video media is effective not only for students involved in the initial trial but also for those with no prior exposure, demonstrating consistent effectiveness across different instructional contexts.

Although parametric tests such as the paired t-test require individual-level data, the consistent increase in mean scores, supported by meaningful effect size estimates, suggests that the observed improvements reflect a genuine intervention effect rather than random variation. This interpretation is consistent with the practical emphasis of development research on educational significance rather than solely statistical significance (Hattie, 2009). The moderate-to-large effect sizes indicate that the Teaching Factory video media has a substantial impact on learning outcomes.

Methodologically, including a class that did not participate in the initial trial strengthens the study's validity. Borg & Gall (2003) argue that testing products across different groups is essential to ensure generalizability, while Sugiyono (2015) emphasizes involving diverse participants to improve objectivity and reliability.

The improvement in learning outcomes is further explained by the Cognitive Theory of Multimedia Learning Mayer (2009), as authentic video simulations integrate visual and auditory information to connect theory with real-world practice. Overall, the findings demonstrate that the Teaching Factory-based video learning media is highly effective and suitable for broader implementation in vocational hospitality education.

Discussion

The findings demonstrate that the Teaching Factory (Tefa)-based video learning media possess high validity, practicality, and effectiveness. These results confirm not only the technical and pedagogical feasibility of the product but also its ability to address the persistent gap between theoretical instruction and industry-oriented practice in vocational education. From an instructional design perspective, the media's effectiveness can be explained through the Cognitive Theory of Multimedia Learning Mayer (2009), which emphasizes integrating visual and auditory information to enhance learning. The application of coherence, signaling, modality, and contiguity principles reduces extraneous cognitive load and enables learners to focus on essential content. This supports Fiorella & Mayer (2021), while extending previous research by embedding authentic workplace contexts that facilitate meaningful transfer of learning into practice (Widana et al., 2021).

From a content perspective, the strong alignment among instructional materials, curriculum standards, and industry requirements reflects effective constructive alignment (Biggs & Tang, 2011). Unlike conventional approaches that separate theory and practice, the developed media integrates learning objectives with authentic workplace activities. The involvement of industry stakeholders (DUDI) further ensures that targeted competencies reflect real professional demands, consistent with UNESCO-UNEVOC (2019) and Rintala & Nokelainen (2020). From the user perspective, the high usability indicates careful attention to user experience, supporting Nielsen (2012), who identifies usability as a key factor in successful educational technology integration. The improved performance in the extended trial (PH3) also demonstrates the media's stability across learning contexts. Compared with Zhang et al. (2021), who emphasize simplicity in video design, this study achieves a balance between content richness and accessibility.

The media's attractiveness contributes substantially to its effectiveness. High student engagement fulfils the Attention and Relevance components of the ARCS model Keller (2010) supporting findings by Chen & Wu (2022) and Al Mamun et al. (2023). Beyond increasing motivation, this study shows that engagement also promotes behavioural change in professional contexts. A major contribution of this study is improving students' soft skills, particularly communication, professionalism, and service ethics. Behavioural observations indicate that students internalised hospitality values such as friendliness, empathy, and responsiveness. This finding is consistent with Social Learning Theory Bandura (1971), where video serves as an effective behavioural model, enabling students to adopt professional conduct more effectively than conventional instruction. The findings are also supported by situated and experiential learning perspectives, as authentic scenarios provide meaningful learning experiences that strengthen professional competence (Guo et al., 2020; Wesselink et al., 2021; Widana et al., 2023). Unlike earlier studies focusing mainly on cognitive outcomes, this research demonstrates significant benefits across cognitive, affective, and psychomotor domains.

Finally, significant improvements in pretest–posttest scores across both experimental groups, including those not involved in the initial trial, indicate strong external validity and generalizability. Consistent with development research principles (Borg & Gall, 2003; Sugiyono, 2015), the media is not only internally effective but also suitable for wider implementation. Overall, the integration

of learning theory, authentic industry contexts, and multimedia technology represents a meaningful advancement over previous studies.

Conclusion

This study concludes that the development of Teaching Factory-based video learning media is highly effective in improving students' learning outcomes. This is evidenced by consistent improvements in pretest–posttest scores, supported by effect sizes in the moderate-to-large range. These findings indicate that the intervention provides not only statistical significance but also meaningful educational impact, particularly in fostering contextual and applied learning. The findings suggest that Tefa-based video learning media can serve as a strategic alternative in vocational and practice-based education. The media effectively bridges the gap between theory and practice by providing authentic, industry-relevant learning experiences. Additionally, this study offers educators and curriculum developers valuable insights into integrating industry-based approaches into instructional design. Future implementation should consider diverse learner characteristics and learning environments to further optimize effectiveness.

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